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Model farmers, extension networks and the politics of agricultural knowledge transfer

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ABSTRACT

Model farmers are a common feature of many developing world agricultural extension networks within which they demonstrate new cultivation techniques and technologies to local communities. The diverse political-economic and socio-cultural roles that such farmers assume, however, are rarely afforded critical scrutiny. To do so, we emphasise the ways in which model farmers facilitate not only the production and transfer of knowledge but also of materials and legitimacy. These transfers occur both horizontally to community members and vertically through linkages with extension agents, research institutions and private sector interests. We establish how these transfers have important impacts upon both efficiency and equity. To illustrate, we use examples of model farmers drawn from research on hybrid rice dissemination in Mandya district, Karnataka. Despite having the same official functions within the extension network, the model farmers we surveyed assumed strongly different roles with notable implications for the effectiveness of knowledge transfer alongside equity considerations.

1. Introduction

The use of model farmers is a common feature of agricultural extension strategies that seek to diffuse new technologies and practices among smallholder populations in the developing world (Franzel et al., 2013). Model farmers are used by extension agencies to serve as in-community representatives for new agricultural inputs or cultivation techniques. They are envisaged to play a dual role. First, model farmers provide an entry point into a community for the diffusion of a new practice or technology. By creating an observable, field-level demonstration to be witnessed in real time by other farmers in the locality, model farmers provide a practical example of the innovation and its purported benefits. Second, they also assume a directly didactic role in which they instruct community members in the new technology and potentially help troubleshoot problems that arise in implementation. Model farmers therein serve as a community repository of knowledge while also helping to translate and embed an agricultural innovation into local contexts. On this basis model farmers may play a foundational role in a process of knowledge transfer through which new techniques are disseminated across a target population.

Model farmers, however, do more than simply diffuse technical knowledge. As we elaborate analytically and empirically, they also assume broader political-economic and socio-cultural roles as part of extension networks. As rural sociologists, three elements strike us as notable. First, by acting as nexus points in the flow of information, subsidies and material inputs between extension agencies and local communities, model farmers assume positions as gatekeepers to valued resources. This role can alter or reinforce local power relations and access to profitable opportunities. Second, as exemplars of agricultural innovation, model farmers generate considerable prestige from their position within extension networks that can similarly consolidate or unsettle local hierarchies. Third, model farmers also play an important role in the production of political legitimacy for research and extension agencies that are keen to promote the success of local initiatives. With constrained levels of funding within public agronomic services, there exists a pressing need for research and extension agencies to produce demonstrated 'success stories' of disseminated innovations (Sumberg et al., 2012a). This requirement can consolidate the status of model farmers as key tools of external success demonstration (Flachs, 2017).

Despite their importance, these broader roles surrounding the transfer of knowledge, the brokering of material resources and the generation of legitimacy have received little focused attention within recent academic literature (Röling et al., 1976 is an early and notable exception). Such an omission is problematic because variations in the political-economic and socio-cultural roles that model farmers assume can produce great differences in their practical forms and functions.

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This leads to a range of intended and unintended effects with positive and negative implications for both technology transfer and equity concerns. Given that model farmers remain a focal tool for extension delivery in many development contexts – notably they are the fulcrum of current Farmer-to-Farmer (F2F) approaches (Franzel et al., 2014; Meena et al., 2016; Samari and Sabouri, 2013; Tsafack et al., 2015) – there is a pressing need for critical perspectives on the opportunities and challenges involved in their usage.

To situate model farmers within contemporary extension contexts, we first examine the historical role of model farmers within extension services from the 1970s onwards. While the use of model farmers has long historical antecedents, we begin our discussion with the Training and Visit (T&V) system promoted by the World Bank across the period 1970–1990 that systemised and propagated their usage in developing world contexts. Moving beyond T&V, we then taxonomise the varied functions that model farmers assume in contemporary contexts, identifying and analysing their roles in generating flows of information, brokering material resources and building legitimacy between researchers, extension agents, neighbouring farmers, the local community and – increasingly – the private sector and non-governmental organisations. In so doing, we highlight the political-economic and socio-cultural processes operating within these networks that stretch far beyond the explicit goal of knowledge transfer. This taxonomisation is useful for both empirical research and project design as it indicates substantive constraints of the model farmer system that are often left implicit within official extension discourses. Specifically, we demonstrate how, despite a common central purpose, model farmers in practice can play very different roles depending on which combination of functions predominates.

Finally, we illustrate these issues empirically through concise examples of three model farmers encountered during research on hybrid rice promotion in southern India. Despite ostensibly playing the same formal role in extension networks, the latter exemplified the varied political-economic and socio-cultural functions model farmers play in agricultural extension and technology transfer. In conclusion we reflect on the policy implications of the knowledge politics that accompany model farmer use.

2. Model farmers in agricultural technology transfer

The use of model farmers has been a longstanding feature of extension initiatives in developing world contexts, with the strategy being employed in parts of Latin America and the Philippines from the 1950s onwards (Selener et al., 1997). The contemporary prevalence of model farmers within extension networks in many Asian and African contexts, however, is to a considerable extent a legacy of the Training and Visit (T&V) system of extension that was heavily promoted by the World Bank during the 1970s and 1980s (Musa et al., 2013). This extensive governmental initiative both formalised and generalised model farmers as a lynchpin of modern extension strategies, setting operational templates and normative expectations about model farmer usage that remain influential today.

Aimed at creating a streamlined and more efficient system of extension to disseminate advanced research to farmers, the T&V system promoted a three-tier chain of knowledge transfer to link public sector researchers through extension agencies down to smallholder farmers. First, agricultural researchers working within public research institutions were charged with providing direct and extensive training about plant varieties, new technologies and farm management innovations to a cadre of extension agents. The latter would, secondly, deliver these improvements at the community level by recruiting model farmers - known as 'contact farmers in the T&V lexicon - as local implementers and demonstrators of the technology in question. Third, the model farmer would subsequently disseminate the information gleaned from extension visits to a further set of 10–15 neighbouring farmers and allow their fields to be inspected by those curious to see practical examples of the new techniques, crops or inputs. Extension agents were expected to visit model farmers in their fields on a bi-weekly schedule throughout the growing season to provide supplemental training and troubleshoot cultivation issues.

The T&V initiative sought to channel scientific expertise towards food production crops as grown by the vast majority of small and medium farmers, thereby moving activities away from a colonial-era focus on plantations and export crops typically grown by rural elites. The systematic usage of model farmers within this strategy was designed to address a number of key constraints associated with the diffusion of techniques and technologies at such scale. As Niels Röling argued, effective technology transfer requires a strongly embedded process of communication between resource and user communities. This cannot easily be established without substantial network building to establish “agendas, ground rules, appropriate media and an understanding of internal processes and contextual factors” (Röling, 1990 19). Generating effective communication, therefore, is time consuming, socially challenging, and requires a degree of long-term relationship building that often exceeds the capacities of both extension agents and communities (Leeuwis, 2004). This is particularly the case when attempting to scale up extension activities across geographically widespread and socially heterogeneous target populations.

Given these constraints, incorporating model farmers as surrogates for extension activities often appears to be a more feasible strategy than building substantive direct linkages across target communities. From the perspective of extension agencies – both in the T&V period but also in contemporary initiatives – investing in a relationship with a model farmer who can disseminate technologies through local networks can be a significant shortcut to smooth the diffusion of agricultural innovations by promoting a process of embedded learning within a community wherein information and experiences are passed internally between cultivators (Leeuwis, 2004). Extension agents typically assume that carefully selected model farmers will already have a leadership role within local social networks and therefore possess robust communication channels with local farmers through which knowledge can be efficiently transferred. Such advantages can be further multiplied if the chosen farmer has sufficient social influence to guarantee a strong local buy-in for a particular agricultural innovation. Finally, a knowledgeable and potentially innovative model farmer is more likely to be able to adapt a technique or technology to local conditions than either extension agents or primary researchers.

It was on this basis that the T&V system – with the model farmer at its heart – appeared to offer a strategy of extension that could be applied at a broad scale across diverse local contexts with relatively predictable results. It is also the basis on which contemporary Farmer-to-Farmer systems are founded. Notwithstanding its widespread propagation, however, some analysts raised concerns over conflicts of interest surrounding the role of model farmers and their potential for personal advancement (Röling et al., 1976). This was reflected in the initial choice of who could be a model farmer. Practitioners such as Feder and Slade, for example, noted that the selection process of model farmers reflected an inherent tension in the dissemination of externally derived agricultural innovations:

> *While their potential for opinion leadership on matters of crop husbandry is the key criterion, they should not be exceptional in their command of resources lest other farmers fail to imitate them, attributing their achievements to their wealth not to the application of improved practices. There is an obvious trade-off between choosing those farmers who will adopt innovations most speedily and those who are somewhat less suitable … but whose resource position is typical of the majority of farmers and hence, their behavior more readily imitated* (Feder and Slade, 1984).

While aware of this intrinsic trade-off, the balance of selecting model farmers within T&V was one that repeatedly fell in favour of more educated, well-connected and almost exclusively male

individuals. In part this is because existing extension efforts from the colonial period onwards had privileged relatively affluent farmers therein creating longstanding networks that proved hard to break, particularly when they appeared conducive to organisational goals. Röling, Ascroft and Chege (1976) identified this as the 'path of least resistance' for extension agents. Not only do farmers with a sound asset base and greater education provide a stronger guarantee of being able to effectively learn and implement externally generated techniques and technologies, their position within socio-cultural hierarchies can magnify their demonstration effect or tutelage role within a local target audience. Simultaneously, as John Howell noted in his study of T&V in Nigeria, model farmers tend to become contacts for a wider range of functions than simply crop extension, including the distribution of inputs connected to the projects – either through public agencies or the private sector (Howell, 1982). This role in material resource transfer privileged those farmers that already had a foothold in such roles and raised the prospect that becoming a model farmer was a means to secure existing positions in local commercial networks.

What this literature implied was that model farmers assumed functions with important political-economic and socio-cultural dimensions that went beyond the envisaged role of technical knowledge dissemination. As conduits between extension agencies and smallholder communities, model farmers became gatekeepers of knowledge and material resources and therein assumed functions of power within rural social relations. Jonathan Pattenden (2011) defines gatekeeping as "the act of channelling formal and informal resources between the state and society for private economic and political gain" and this function became increasingly notable as T&V became more established. As Ewell noted referring to studies in both Zambia and Nepal, model farmers quickly began to expect concrete benefits from their work as model farmers or would refuse to partake in schemes (Ewell, 1990). At the same time, these networks reinforced extent hierarchies that favoured men and greatly excluded women farmers, with both extension agents and model farmers being overwhelmingly male in composition (Saito and Weidermann, 1990; Windapo, 2002).

3. Model farmers beyond T&V

While T&V systems as a fully integrated package of extension activities lost policy backing in the 1990s – falling victim primarily to fiscal constraints in an era of structural adjustment and shifting governmental priorities (Anderson et al., 2006) – the use of model farmers has remained an important tool within succeeding extension strategies, including contemporary transfer of technology policies, Farmer-to-Farmer (F2F) models (Franzel et al., 2013) and agricultural innovation platforms (Klerkx et al., 2013). This persistence of model farmers remains in no small measure because the central challenges that T&V was designed to overcome – including access and communication problems between agricultural researchers, extension agents and communities – remain pertinent to contemporary operations. At the same time, the use of community representatives to scale out extension initiatives is seen as a cost effective means of reaching a larger client base in conditions of constrained financing.

Consider, for example, the Farmer-to-Farmer (F2F) approach used within both governmental and non-governmental extension initiatives across multiple development contexts (Franzel et al., 2014). This framework largely replicates the functions of model farmers within T&V, in which the underlying premise is that a cadre of farmer-trainers "are trained by external agents and they in turn share their knowledge and skills with other farmers in the community" (Kiptot and Franzel, 2015 505). While F2F models demonstrate a strong inheritance from T&V, they diverge by seeking to engage a greater participatory ethos within the system. In F2F, model farmers are intended to act as conduits of information from farmers back to extension authorities about local problem-solving and adaptations to create a more dynamic and demand-driven system. At the same time, many F2F systems advocate that communities or farmer organisations rather than extension agents should play the primary role in choosing who becomes a model farmer (Franzel et al., 2014).

As we address below, however such laudable participatory intentions can face significant practical challenges. Notably, the F2F initiatives surveyed by Simpson et al. (2015) were integrated within large-scale agricultural modernisation programmes that proceeded on the basis of diffusing a precise set of externally identified technologies and practices. There is clearly a tension in such programmes between an institutional framework of model farmers recruited to demonstrate techniques from the outside and the aspiration for locally driven innovation in which farmers are involved in identifying key requirements, constraints and potential solutions. As Franzel et al. duly caution, the F2F model runs a constant risk of becoming "an arm of a top-down technology transfer model, in which communication is one-way, from extension staff to farmer-trainers to farmers" (Franzel et al., 2015: 2).

In part, such tensions highlight the lack of explicit engagement at conceptual and planning levels with the broader social and political roles that model farmers assume that complicate their role as agents of knowledge transfer. A survey of 460 model farmers involved in F2F livestock programmes in Uganda, Cameroon and Malawi, for example, illustrated that personal gain is self-reported by around 60 percent of model farmers as their primary motivation for project involvement. Enhanced social status, networking, material transfers and opportunities for further income generation were also self-reported as a major determining factors, yet quite how these complex social dynamics affected programme operations and local hierarchies were unexplored in that study (Simpson et al., 2015). Similarly, it is often assumed that because the model farmer is from the community the initiative has a participatory quality. This may be an adequate assumption in some cases, but as we demonstrate below, participatory dynamics in practice are often far more complex given that communities typically betray significant internal power relations and local hierarchies (see also Cooke and Kothari, 2001).

In the case of contemporary public sector extension initiatives, these issues may be further complicated by two further shifts in the broader political economy of agricultural extension. First, the private sector and non-governmental organisations have assumed a far greater presence in the creation, marketing and diffusion of new agricultural technologies. As a result public sector agencies often need extension tools to actively break into a competitive marketplace for agricultural innovations, which has changed the tone of some extension strategies. Second, and concurrently, public sector agricultural research is now increasingly defined by private sector rubrics and competition. Many researchers are pressured to deliver agricultural innovations that can be commercialised through sale of intellectual property rights to private sector. Producing marketable outputs with demonstrable short-term results now orientates many contemporary agricultural policy and research priorities (Sumberg et al., 2012b).

To conceptualise more fully these changing trends and roles, we provide a stylised taxonomy of the relationships that model farmers assume based on the three primary functions indicated above: transferring knowledge; brokering material resources; and the generation of legitimacy. Fig. 1 offers a diagram of these varied roles in relation to extension agencies, local client farmers and the private sector. It emphasises the reciprocal relationships of knowledge transfer, material resources and legitimation between these agents, with flows potentially moving in both directions. As we illustrate below through empirical examples, in practice model farmers display distinct combinations of these core functions depending on the nature of the networks and local social contexts in which they are embedded. This creates significant variation in their practical impacts on processes of technology diffusion alongside the potential to transform or consolidate local power structures.

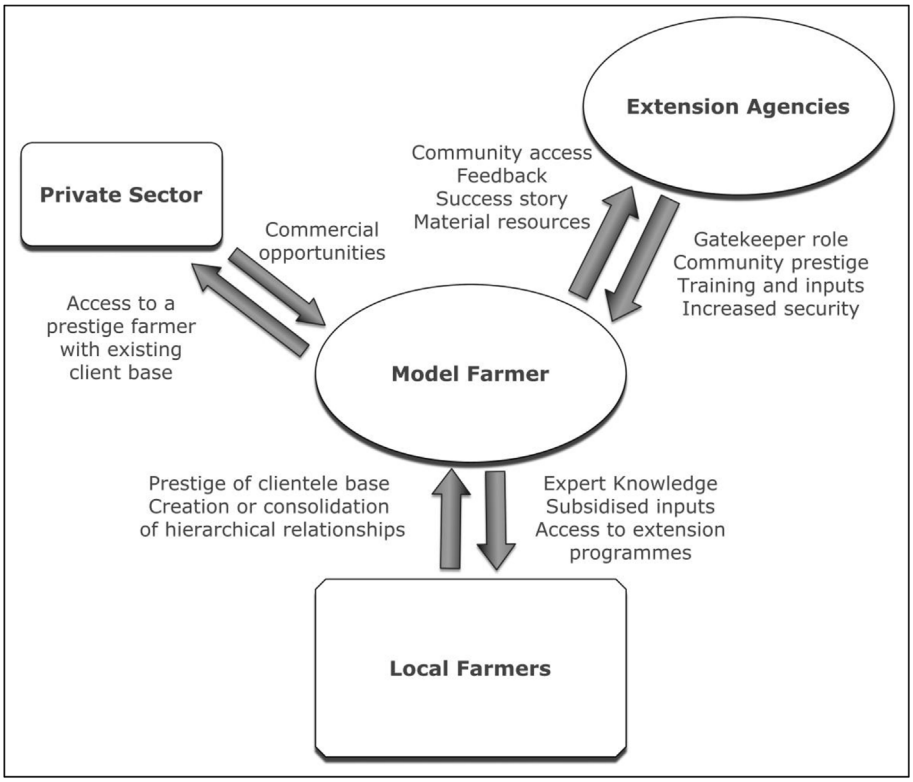


Fig. 1. Key relationships in a model farmer network.

3.1. Knowledge transfer

The formal role of model farmers is to offer an amplification point in the transmission of knowledge necessary to diffuse agricultural innovations from research and extension services to a wider clientele of farmers. As noted above, model farmers are seen as a partial solution to longstanding concerns about the limited effectiveness of externally driven extension models in which outside experts attempt to directly introduce and instruct upon new technologies, inputs or cultivation techniques (Chambers et al., 1989; Leeuwis, 2004; Stone, 2016). Studies on farmer learning clearly indicated that an external, didactic approach to instruction was less effective than embedded learning in which farmers share their individual experiences with new technologies, address common problems and learn – in part – as a collective (Melkote, 1987). As the original T&V system sought to establish, the use of model farmers potentially offered the best of both approaches: a directly pedagogic external extension buttressed by a model-farmer driven process of in-situ learning.

Within this knowledge transfer schematic, model farmers typically assume a combination of four key roles, although the emphasis between them may vary. These are (i) a *demonstration role* by having a field planted with a new crop or using new technology for casual observation by peers, (ii) a *focus point role* in which local farmers come to the model farmer's field for instruction by outside agents; (iii) a *direct tutelage role* in which the model farmer advocates for and explains new technologies, including troubleshooting problems on other farmer's fields; and (iv) a *peer pressure role* in which model farmers explicitly or implicitly set a social standard by which the agricultural knowledge and cultivation practices of others is judged. Among these roles, part of the value-added by model farmers is a potential translation effect in which model farmers are better able to represent the aims and practices of new technologies in terms and context that local farmers understand. Furthermore, through their own experimentation they can potentially adapt externally generated technologies for local agro-environmental conditions, creating more appropriate and durable innovations that can then be passed on to others.

An inevitable by-product of this institutional arrangement is that model farmers become key nodal points in the diffusion of knowledge and therein operate as gatekeepers for flows of information coming from extension agencies. What is less commented upon is that this role as knowledge brokers empowers model farmers leading to a range of intended and unintended social outcomes. From the perspective of extension agents, ensuring that model farmers are indeed models of success is a prerequisite for effective diffusion. As a result, the latter are typically given special attention that can easily stretch beyond the new technology or technique in question to a broader spectrum of information and troubleshooting about their agricultural operations. They therefore garner privileged information and tutelage about the deployment and troubleshooting of new technologies. The expectation, of course, is that model farmers will then become active and proficient diffusers of this knowledge, potentially translating it into a more relatable form for local audiences.

There are, however, two important risks in establishing this gatekeeping role. First, model farmers may create a strong inclusion/exclusion dynamic wherein farmers situated within their established social networks are granted access to information whereas those at the margins or outside such networks are excluded from the knowledge transfer process. This dynamic can form around immediate friendship, kin and peer networks, or can operate along lines of class, gender, religion and caste. Within the south Asian context, for example, such inclusion/exclusion dynamics have been strongly noted in the networks surrounding microfinance promotion and self-help groups (Pattenden, 2011; Picherit, 2015). Farmers excluded from agricultural knowledge transfer may either ignore the new technology or attempt to emulate it without the benefit of access to the direct pedagogy facilitated within the network, therein increasing their potential for crop failure.

A second risk of the knowledge broker function is the creation of new or deepened dependencies between actors within the network. What is often obscured in the official narratives of extension operations is that farmers and their households do not simply interact with one

another as neighbours who may choose to exchange knowledge about agricultural experiences. Rather, households are closely bound up in complex social relations as providers of labour, renters of land, sources of credit, providers of political support and other crucial socio-economic functions. In this way, the social fabric of rural communities is typically composed of persistent and frequently unequal inter-household relationships that can betray strongly engrained hierarchies of class, gender, ethnicity and other social markers that persist over time (Mosse, 2010; Taylor and Bhasme, 2018).

These unequal exchanges and can be particularly present in credit relationships, in which informal lending from privileged actors consolidates dependency relationships that can require reciprocal obligations such as labouring duties, land rentals or fixed contracts for agricultural outputs (Guérin et al., 2011; Guyer, 2004). Given the opaque nature of these relationships to outsiders, quite where the threshold lies between empowering model farmers as agents of knowledge transfer and empowering them as social agents within local hierarchies and dependency relations can be unclear for extension agents. Adding the role of knowledge broker to these rural social relations can therein have important yet overlooked effects on such power imbalances. As the cases below exemplify, transferring knowledge through a preponderantly male network of extension officers and model farmers consolidates gendered hierarchies, dependencies and divisions of labour. Notably, some F2F approaches have sought to address this problem through the active recruitment of female model farmers, although imbalances still remain (Kiptot and Franzel, 2015).

Finally, the knowledge transfer function of model farmers is not unidirectional. Model farmers are in a position to provide consistent information back to agricultural researchers and extension agents. This reverse flow can provide a source of useful information about on-field opportunities and constraints encountered with new technologies – effectively a testing function – and also about the broader reception of new technologies among farmers, including potential agroecological and/or cultural blockages to adoption. Many researchers within public institutions have a degree of isolation from direct cultivators and can rely upon model farmers to relay information from within local communities. Functioning properly, model farmer extension systems should facilitate a two-way flow of information in which community experiences, demands and innovations can reach and influence researchers or extension officers through the medium of model farmers.

There are, however, three potential tensions. First is that – in smaller extension operations - researchers can become reliant on key individuals who may be partial in their portrayal of the needs, opinions and experiences of a larger farmer base. In some cases, there can be a built-in impetus for the model farmer to present information calculated to perpetuate a beneficial relationship with research or extension agencies, rather than disclosing – for instance – that a particular innovation was irrelevant to local needs or ill-suited to local conditions. Second, there may be cases when the feedback of model farmers does not meet the criteria and objectives of the researchers and extension agents. In such cases, researchers and extension agencies have the power to ignore such feedback and can, therein, sideline the views of the model farmer in the given context in order to preserve institutional priorities. Third, while some F2F systems actively proscribe the need for feedback from model farmers, this can take the form of local refinements to externally generated technologies rather than a deeper empowering of local priorities and innovations as projected by grassroots farmer advocates (Chambers et al., 1989; Scoones and Thompson, 2009).

3.2. Brokering material resources

Alongside their role as knowledge brokers, model farmers frequently become central nodes in the flow of material resources. For research and extension units seeking to generalise agricultural innovations, the provision of free or heavily subsidised inputs or other rewards often forms an important tool to promote uptake of the innovation among potentially sceptical client farmers (Leeuwis, 2004 78). As an example, in a public programme to promote the system of rice intensification in rural south India, Taylor and Bhasme note how specialised weeders and field marking equipment were given as part of extension operations and sometimes deposited with a model farmer for lending onwards to a peer group alongside free fertilisers and monetary subsidies to offset increased labour costs (Taylor and Bhasme, 2018). Similar material transfers are noted below in the context of hybrid rice promotion.

From an extension perspective, there are good reasons for supporting model farmers and their clients with subsidised resources. Ensuring that a model farmer executes an effective field demonstration of the agricultural innovation typically means that extension services are keen to invest in that farmer through subsidised or free inputs, keen tutelage, guaranteed crop purchases at fixed rates, or insurance against failure (see Maat and Glover, 2012). In this manner, becoming a model farmer can be a gainful endeavour by either reducing input costs or by securing guarantees from extension services against cultivation risks should the innovation prove unsuccessful. Given that more affluent individuals are better positioned to enter extension networks as model farmers, this can further entrench local hierarchies and social differentiation.

At a community level, material flows to farmers targeted by an extension programme are often directed – in part – through model farmers who take on the role of storing and distributing inputs such as seeds, tools and machinery. On the positive side of this brokering role, model farmers can provide client farmers with personal direction on the technical use of these potentially novel inputs. Whereas agricultural extension agents often concentrate their instruction at the beginning of a season, model farmers are better positioned to work diachronically with farmers in generating the tacit knowledge of input/technology use within practical settings throughout the season. Model farmers can therefore be well placed to remind others of the technical specifications of input deployment at the time of application. At the same time, model farmers also can play a role in the organization of financial flows. Beyond potentially organising monetary subsidies from extension agencies, they may also coordinate public or private sector credit applications on behalf of the collective.

While these roles can certainly be beneficial for client farmers, they can also further empower model farmers as gatekeepers of potentially lucrative material or financial resources, therein reinforcing their role as knowledge brokers with that of resource broker. This is not to suggest that explicit corruption is a necessary facet of such material flows – although such an occurrence is possible (Pattenden, 2011). Rather it is to indicate that, even in best-case scenarios, model farmers become tangible brokers for valued material resources, therein consolidating their political-economic and socio-cultural position. Notably, many cultivators look to input dealing as a potential way to move into more lucrative pursuits without the risks inherent to direct agricultural production (Aga, 2018). Male farmers in particular frequently view engaging in input dealing as an important means of supplementing fickle agricultural income or even a step towards transitioning out of agriculture entirely. This was noted to be an important motivation for model farmers dating back to the original T&V period (Ewell, 1990).

Finally, a small but important point that emerges from our research is that, in some networks, model farmers can reciprocate material flows back to research centres. For instance, they can either directly produce quality-controlled seeds, or indirectly arrange for their production in their areas of influence. Other farmers have produced resources such as high-quality vermicompost that is then cycled back to agricultural extension agencies who use it to demonstrate to other farmers. This role as producers of valued materials is particularly important in the context of hybrid seed production, as discussed below, wherein a substantial level of technically capacity within cultivation is needed to ensure the purity of the variety. When scaling up production of a new variety, model

farmers can be directly incorporated into seed cultivation networks with good financial compensation.

3.3. Generating legitimacy and prestige

Central within the dynamics of the model farmer system is the targeted generation of legitimacy and prestige. On the one hand, the system depends on the relative prestige of the model farmer as a trusted representative of good agricultural practice. Without strong social standing, local cultivators are less likely to listen to or attempt to emulate the model farmer. On the other, by harnessing the prestige of a model farmer – and by consolidating it through their patronage – extension agents hope to confer legitimacy upon the agricultural techniques, tools or materials they wish to diffuse. As Glenn Stone noted in his account of social learning among Indian cotton farmers, in conditions of flux in seed markets and management techniques, cultivators can be swayed about the legitimacy of an agricultural innovation first and foremost according to the social standing of neighbouring farmers that are using it rather than proven results or suitability to local agroecological conditions (Stone, 2016).

These points have been suitably taken up in the work of Andrew Flachs on what he terms 'show farmers' within competing models of sustainable farming in Telangana, India (Flachs, 2017). Flachs analyses how a set of show farmers were identified and then cultivated by non-governmental organisations to play a totemic role as practitioners and exemplars of organic agriculture. Within Flachs' rubric, show farmers adopt an explicit publicity role as an embodiment of the 'sustainable' practices funded by the agency at hand. As models of sustainability, their farms must be continually prepared to receive external visitors – funders, scientists, media, academics or other cultivators – who needed living proof of the methods extolled by the project. Building on Stone's earlier observations (Stone, 2014), Flachs explores in detail the tensions inherent to this role, highlighting how the cultivation of show farmers requires a consistent flow of material resources and knowledge that can be tenuous and, if political conditions or priorities shift, at risk of collapse.

While Flach's examples were sourced from NGO and corporate driven programmes, public extension operations increasingly compete on this same terrain. They often require a similar generation of local 'success stories' to help secure institutional legitimacy and funding flows. Within the changing context of agrarian societies, however, such prestige can be readily translated into social fields beyond the immediate extension network. A successful and prestigious model farmer, for example, may build up networks not only with extension agencies but also with private sector agents, political parties or representatives, wider governmental bodies and the non-governmental sector. For the local community, such a farmer can be a positive ally in the competition for resources, particularly if they become adept at navigating external bureaucracies and networks. Notably, the use of model farmers transcends the public sphere, with both the private sector and NGOs aware that prestige farmers are an important means of diffusing products or services into local communities. Clearly, as intermediaries in this process, model farmers can once again consolidate their status as privileged gatekeepers among their peers and open new opportunities for personal enrichment.

Finally, yet importantly, while extension agencies cultivate legitimacy and prestige for model farmers, the opposite is equally true. With extension agencies increasingly pressured to project tangible outcomes and success stories, mobilising model farmers as a way to facilitate a relatively rapid uptake of a newly developed variety or technology can be of paramount importance (Flachs, 2017). By managing the uptake of an agricultural innovation, model farmers may provide what Sumberg, Irving, Adams and Thompson term 'agricultural success stories' that can be publicised as a necessary embellishment for public and private agencies seeking recognition and further funding (Sumberg et al., 2012a). Indeed, it is this legitimisation function of agricultural research to which we now turn with an empirical focus.

4. Model farmers and hybrid rice diffusion in rural Karnataka

To exemplify this discussion, we provide examples of three different model farmers involved in extension networks in south India, each of whom assumed different combinations of knowledge transfer, brokering materials, and generating prestige and legitimacy within the specific contexts of their localities. As a result, the three different model farmers in question assumed notably different roles despite formally having the same mandate and being tied into a common network headed by a regional agricultural university and zonal research station.

Our interaction with these farmers came in the context of a qualitative study of the diffusion of a new hybrid rice variety in Mandya district of Karnataka. Created by researchers at the agricultural university, this hybrid was argued to produce superior yields and a good quantity of straw while being closely attuned to local agroecological conditions. The envisaged form of dissemination constituted a relatively standard example of a "transfer of technology role" in which an externally generated agricultural breakthrough is transferred to extension agents and then 'delivered' to users with appropriate guidance on how to maximize its benefits as an adopted innovation (Chambers and Jiggins, 1987). In this case, hybrid rice cultivation requires not only the use of special seeds but also altered management practices and input usage. Notably, there are key differences in the transplanting process and in the nutrient regime in comparison to standard high-yield varieties (HYVs) and traditional varieties (Krishna, 2010). The researchers and extension agencies involved with the hybrid therefore rightly considered that effective diffusion necessitated a knowledge transfer process to accompany the provision of seeds, particularly as there was little widespread knowledge of hybrid paddy production techniques in this region.

The context in which this new hybrid seed would be diffused, however, was one of an increasingly commercialised and competitive market for both inputs and outputs. As Reddy (2017) notes, in many parts of south India farmer self-production of paddy seed has drastically reduced over the past decade and has been supplanted by commercially produced seeds that are bought annually from input merchants. This commercialisation of the agrarian environment reflects a broader political economic trend in which there is a pronounced process of social differentiation among the smallholder population, a sizeable proportion of whom struggle to reconcile the pressures of a competitive and austere agrarian environment that is beset by mounting incidences of climatic variability and drought conditions (Pattenden, 2016; Prakash Kammardi et al., 2017). This is particularly the case in Mandya, wherein farmers using intensive cropping systems have been facing rising costs of production alongside stagnant prices for many key agricultural commodities in the context of growing uncertainty about the availability of irrigation waters flowing from the Cauvery canal system.

For researchers at the agricultural university, designing high-yielding modern cultivars adapted to local conditions was argued to be part and parcel of a strategy to restore smallholder prosperity alongside boosting the regional yield ceiling. Within this context, the university agencies that had developed the hybrid required an extension strategy that could break into local markets despite competition from the private sector. This would have to be undertaken, moreover, in conditions of budgetary constraints in which researchers found themselves taken on other functions such as helping coordinate extension. While the university does have its own extension arm who were involved, the researchers who developed the hybrid nonetheless felt the need to be directly involved in propagating the variety in order to attempt to ensure its success.

On top of this imposition, moreover, the developers of the hybrid saw the generation of a well-publicised local success story as a necessary complement to their broader aim of getting the variety

commercialised. With the university research station unable to produce large quantities of the seed and the absence of a national public seed producer, the ultimate aim of researchers was to submit the variety for tender in the private sector and arrange a sale that would transfer the knowledge and parent lines for producing the hybrid to a private company for national distribution. While researchers felt that they would not receive a fair price for the intellectual property rights of the hybrid they had developed, they begrudgingly acknowledged that commercialisation was the only way to secure a national release. Being able to label the variety as a local 'success-story' that was well-received by farmers and picked up by the media would form part of a prospective marketing package for later commercialisation.

To help achieve these aims, extension agents enrolled a series of model farmers as regional intermediaries who could take up the duel function of training client farmers in the use of the hybrid and generating localised examples of extension success. By supporting this network with subsidised seeds and inputs, university researchers sought to coordinate a rapid yet concentrated uptake within selected villages. At one level, this strategy aimed to diffuse the variety regionally through a demonstration effect that could be amplified by publicity in local newspapers. This public relations aspect was centrally important to the extension strategy. Press releases – including two articles in leading English-language national newspaper *The Hindu* – promoted the virtues of the variety and claimed that farmers across the district were coming forward in considerable numbers to cultivate it.

Such accounts of a spontaneous rush to adopt the variety, however, obscured the coordinated nature of the extension efforts in which model farmers were strategically mobilised to set up cultivation demonstrations and provide seeds and subsidies to local farmers. To understand this extension network, the authors conducted 45 semi-structured interviews with paddy cultivators, millers, input dealers, traders, two sets of extension agents, and scientists at the local agricultural university working on rice breeding, water management and soil health. While initially focused on the social determinants of adoption for this variety, we quickly recognised of the importance of model farmers to extension efforts. Along with thirty smallholder farmers, we interviewed five different model farmers, three of whom we focus on below with the other two not directly involved in diffusion of the hybrid in question. Despite their ostensibly analogous roles within the public diffusion network, our research revealed key differences between the in-situ functions of the model farmers that were directly sustained by the broader political-economic and social-cultural dynamics their roles elicited.

4.1. Model farmer 1

The first of the primary model farmers used by public extension was an educated and relatively more affluent farmer. The latter enjoyed a leadership role in an informal agricultural collective composed of smallholders all of whom held plots around the village's central fields. Without doubt, this mix of small and marginal farmers – notably all men – gained from the knowledge-transfer aspects of the arrangement. For many, the ability to access instruction from a trusted source of knowledge was of considerable benefit and through such tutelage they had become comfortable using specialised inputs – such as hybrid seeds – in conjunction with more complex cultivation techniques such as the system of rice intensification. While the model farmer provided hands-on training, he also appropriated much of the decision making surrounding agricultural production. He selected seeds and methods to use within the group, often according to the needs of outside agencies who wished to showcase particular products. For public extension agencies keen to promote a success story of hybrid adoption, the farmer duly provided a client group of smallholders that could be rapidly mobilised to cultivate the seed and duly showcased in local and national newspaper articles as an example of local farmers adopting the innovation.

In return for following these external prescriptions, client farmers could expect not only direct tutelage from a knowledgeable agriculturalist and occasional visits from university extension officers, but also access to subsidised inputs. In this respect, the model farmer had become a privileged gatekeeper through his close networks with public extension agencies that were consolidated by a family member who worked in the local agronomy department. For the collective, the model farmer coordinated a programme of free seeds and fertiliser delivered to the group over a four-year period from 2012 to 2015. Given that input costs account for a substantial part of yearly smallholder cultivation expenses, these material transfers were of considerable benefit as the subsidies significantly lowered the risks involved in the annual cultivation cycle and reduced the need to take on debts for inputs at the start of the year. These advantages were further amplified in the context of increasingly common and severe droughts that accentuated the possibilities of crop failure.

In the above respect, the extension system appeared to function very much as it was intended. Public agencies acquired a success-story of diffusion for publicity purposes and local farmers received tutelage in the usage of a new input that promised greater yields. There were, however, other dynamics taking place that were silenced in the official discourse. These map into the political-economic and socio-cultural dimensions of model farmers highlighted above. First, for this model farmer, his role within agricultural extension networks helped to consolidate an increasingly important public function as a noted agricultural expert, becoming a regular feature on local radio shows and a go-to person for the print media when discussing agricultural issues. As an example, he had been directly cited within national newspaper publications as a leading voice on the benefits of the hybrid variety that public agencies were promoting.

Notably, the social prestige and networks generated through this facilitation had been translated into a potentially lucrative role in broader commercial activities. At the close of the hybrid promotion period, the farmer negotiated with private sector seed and input companies to act as an advocate on their behalf in a role replicative of his public sector functions as a model farmer. Under these political-economic dynamics, all the client farmers working in the model farmer's immediate group disadopted the public hybrid en masse at the end of the subsidisation period. They instead started using private-sector paddy seeds and inputs supplied via the model farmer that had been subsidised through an agreement brokered between the company, the model farmer and a local politician. In interviews, farmers indicated clearly that their decisions of which varieties to plant were being driven heavily by the subsidised linkages formed by the model farmer – either with commercial or public sector agencies – rather than their own process of experiential learning through comparison of varietal performance in local agroecological conditions (cf. Stone et al., 2014). While it is uncertain the level of personal gain the model farmer received for this brokering role, a clear dependency relation had formed within the group that runs at cross-purposes to the stated aims of extension.

Secondly, we also witnessed an inclusion-exclusion dynamic that we highlighted above as a risk of model farmer systems. For farmers either spatially or socially outside the ambit of the progressive farmer's remit, there appeared to be an important disconnect from the knowledge transfer process. One farmer at the geographical margin of the village had attempted to grow the hybrid using the system of rice intensification technique recommended by university researchers. Despite farmers within the network ably using this approach to cultivate the hybrid seed, this farmer reported his experience as a disaster. Faced with heavy weed growth in the early stages of cultivation, he had chosen to simply plough up the field and replant using standard seeds and cultivation methods. The problem of weed pressure that he described, however, was caused primarily by the omission of a relatively standard component of the system – the use of a specialised cono-weeder – that could have been resolved through a priori instruction or troubleshooting at first emergence of the weeds and provision of the tool through the

model farmer. In short, despite being able to gain complementary hybrid seeds, the farmer was not included within the extension network surrounding the model farmer and complained of a lack of instruction. Elsewhere in the village, farmers outside of the model farmer's immediate network were not swayed by the demonstration effect and did not engage with use of hybrids, preferring to source both new and old high-yield varieties from the private sector.

4.2. Model farmer 2

A strong network between university-based extension and a long-standing model farmer was also present in a second village that was heavily featured in promotional activities by extension agents for the hybrid variety. While slightly more affluent than many of his neighbours based on house size, landholdings and number of livestock, this model farmer was more representative of his peers in terms of class and education than the other two model farmers discussed here. Across his two-decade relationship with university-based extension agents, he had demonstrated a range of new crop varieties, management techniques and cultivation technologies such as the system of rice intensification, drum seeders, integrated pest management and vermicompost usage. In this respect, he was a lynchpin for agricultural knowledge transfer who worked side-by-side with a close group of village farmers in implementing these technologies at a field level. Subsidisation – in terms of free seeds, technology and reduced cost fertiliser – was also routed through this model farmer. In return for this role, he had been successfully nominated for a number of regional 'model farmer' prizes that were displayed in his house, raising his socio-cultural standing among his peers.

Underpinned by this close relationship and the trust it had engendered, the extension network had broadened in scope and scale leading to the designation of the settlement as a 'model village' in its entirety. The latter was a five-year arrangement in which university based extension personnel would use the model farmer to develop close pedagogical relationships with cultivators across the village to trial new technologies and demonstrate them to both local farmers and outside agents including the media. In this respect, there was a strong publicity role to this network, with various showcase launches for new technologies – including the hybrid that formed the focus of our research – held in this village with duly coordinated regional media attention. Notably, while farmers in neighbouring villages were aware of the model status of the village they did not regard it as relevant to their own learning activities. There appeared to be little coordinated intent to incorporate neighbouring villages into the network either by direct tutelage or by a passive demonstration effect. It seemed that the model village status was directed primarily at creating a platform for external agencies (cf. Flachs, 2017).

There was, however, a twist in the tale of the model village. Despite being a showcase demonstration site for the cutting edge of agricultural technologies developed at the local research university, the model farmer and numerous other farmers in the village had increasingly adopted a low-input form of paddy and sugarcane production using traditional varieties without chemical inputs. While they were adamant that they were grateful for the knowledge and material transfers received through public extension, halfway into the their tenure as a model village they had charted a course quite opposed to the technology-driven intensification model that research and extension promoted. Under guidance from the model farmer, all farmers disadopted the hybrid rice variety that the university was promoting and transitioned either back towards standard HYVs or towards the traditional varieties that were circulated among an alternate regional network of low-input farmers (Khadse et al., 2018).

The basis for this shift was that, despite subsidisation, the risks of cultivating technology and input-intensive crops were rising whereas low-input farming strategies minimised the debts that farmers needed to accrue at the beginning of the season. This was particularly the case with the promotion of hybrid seeds that require a strict and intensive synthetic fertiliser regime to gain the promised results, therein raising the costs of input packages and the risks involved. Given that the village in question was located at the tail end of the regional canal irrigation system, the threat imposed by drought upon an already stressed smallholder population was particularly acute. In this context, the presence of a well-established public extension network appeared to be fracturing over the inability of extension agencies to effectively comprehend farmer needs at the recipient end. The model farmer expressed a level of frustration that researchers and extension agencies were unwilling to more fully embrace these alternate forms of agriculture and noted the growing political movement within Karnataka directed at diffusing low-input strategies. On this basis, he had used his agency as a model farmer to embrace a different network of agricultural knowledge transfer outside both public and private sectors. In doing so, the farmer had begun to model a quite different set of agroecological practices that better complemented a risk-adverse cultivation strategy at odds with hybrid rice varieties.

4.3. Model farmer 3

A third model farmer we encountered played a very different role within the extension networks that propagated hybrid rice seed. Well educated, with a BA and MSc in applied agriculture and forestry, he owned significantly more land with better irrigation in comparison to his immediate neighbours and had access to machinery such as mechanical diggers for landscape improvement. While included as a model farmer for the hybrid dissemination programme owing to his existing relationships with extension officers, the farmer had not taken an active role in cultivating a strong network with local farmers. In notable contrast to the close networks formed by the above two model farmers, there appeared to be strong class and social barriers between the farmer and his immediate community. As a result, while this model farmer was open to on-field demonstrations of the hybrid, he complained that his neighbours typically refused to listen to him about using more technologically advanced production methods. This reluctance was undoubtedly in part because his extensive usage of expensive technology – including mechanised field equipment, new varieties and sophisticated irrigation techniques – distanced him from the community who regarded him as a poor archetype for direct knowledge transfer. As such, the farmer appeared to typify Feder and Slade's caution about elite model farmers highlighted during the T&V period some three decades previously (Feder and Slade, 1984).

Notwithstanding this failure to create a strong knowledge transfer network with other cultivators, the farmer's active inclusion within the network appeared to be predicated upon his utility as a trusted producer of hybrid seed for the research institution. This is a role he had strategically pursued, using his access to online communication to supplement direct personal contact with researchers and extension officers. Within the academic-farmer nexus he consolidated a position based on testing new techniques and cultivating paddy seed so as to provide a reliable source of quality hybrid seed back to the university for further distribution. In this manner, he functioned within extension networks less as a pedagogue for diffusion but as trusted source of materials and information flowing upwards towards researchers. Alongside this public role, the farmer had simultaneously consolidated his position as a producer of quality seed for private companies who equally sought out trusted producers to act as contract farmers for the technically demanding process of hybrid paddy seed production. This was a relatively lucrative pursuit, as hybrid seed production offered considerably greater remuneration than grain cultivation. Notwithstanding such strong political-economic spillovers from this role, the farmer resignedly noted that there were no discernible diffusion impacts from his activities. Ironically, his lucrative role within the network's material transfers had served to further undermine his pedagogical function.

5. Conclusion

As we have highlighted both conceptually and empirically, the use of model farmers remains an important tool within the diffusion strategies of contemporary public extension agencies in development contexts. They are used as local conduits to smooth the adoption of a range of externally produced agricultural innovations including new seed varieties, management practices, inputs, tools and machinery, as well as supporting institutions such as crop insurance schemes. For extension agents, strongly embedded relationships with key model farmers typically offer significant benefits. Not only can model farmers diffuse agricultural knowledge through in-situ demonstration and pedagogy, they can potentially translate it into terms and processes more amenable to local contexts, both cultural and agroecological. Concurrently, they can potentially provide valued feedback and – occasionally – useful material resources back to research and extension agencies. Perhaps more importantly given the shifting contexts for public research in the contemporary period, model farmers can provide a means to coordinate local showcases of agricultural success stories for external consumption.

The risks within this schematic, however, have not been fully addressed in extension thinking. Model farmers assume complex social roles that can involve the entrenchment or transformation of extant hierarchies and power relations. Indeed, it is precisely the relative power and influence of potential model farmers that attracts extension agencies in the first place, as they seek out farmers with the requisite access to productive inputs to be successful and who exercise a degree of social authority in the locality. In working with such farmers, extension agencies can further empower model farmers as gatekeepers to valued resources including agricultural knowledge, material inputs, and financial subsidies. In short, there is an inbuilt tension within the system: extension agents need to cultivate model farmers as models of success, but this can play into localised dynamics of social differentiation and dependency with both intended and unintended outcomes.

These political-economic and socio-cultural dynamics have in many ways become increasingly significant in the context of the rapid commercialisation of rural areas in which a new spectrum of actors is actively reshaping the production and diffusion of agricultural technologies. As noted in our empirical examples, model farmers can translate growing prestige generated through their function within public extension networks into potentially lucrative roles with private sector actors who seek to associate and market commercial brands through locally prestigious farmers. Given noted changes in the structure, funding and priorities of many public research and extension activities, however, there are strong pressures upon such agencies to obscure or downplay the complex social impacts of their activities in favour of simplified and linear narratives of adoption success (cf. Mosse, 2005). Marginalising these social dynamics and their unintended outcomes may well be counterproductive to long-term extension goals. As our case study showed, while model farmers were effectively mobilised to create short-term showcases of a technology in practice, there was no evidence of lasting adoption in part because key model farmers shifted their agency into alternate networks connected to the private sector or alternative, grassroots movements.

In response, to better situate their potential to create long-term positive impacts extension agencies need to explicitly address the ways in which their projects reshape the communities they engage. This entails moving beyond success measured narrowly in terms of immediate adoption rates to acknowledge the trade-offs inherent to the very mechanisms through which diffusion is pursued. As James Sumberg (2005) notes, it does agricultural research no favours to ignore such inconvenient contexts or, at best, label them as 'external constraints'. Given that they form intrinsic elements of the model farmer system, extension agencies should make these political-economic and socio-cultural dimensions explicit so that farmers, researchers and extension agents themselves can better conceive of and moderate the inherent risks and tradeoffs within projects. As Feder and Slade (1984) noted at the height of the T&V movement, these concerns first surface at the crucial moment that model farmers are selected. While some public agencies are now cognisant of the need for gender equity in selection criteria (e.g. Andersen and Katchika-Jere, 2014), our cases from south India indicate there remains too often a tendency to travel the path of least resistance by consolidating established networks of model farmers and the hierarchies they express. Ultimately, the failure to address these issues means that public extension risks being steadily outflanked by the commercial power of the private sector on one side and grassroots networks on the other.

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